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on Readiness and Management Support,
Committee on Armed Services, U.S.
Senate

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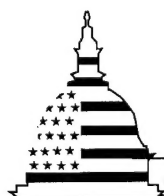
DEPOT MAINTENANCE

Status of the Navy's Pearl Harbor Pilot Project



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Abbreviations

CNO	Chief of Naval Operations
CSMP	Current Ship Maintenance Program
DOD	Department of Defense
NAS	Naval Audit Service
NAVSEA	Naval Sea Systems Command
NIMF	Naval Intermediate Maintenance Facility
NSY & IMF	Naval Shipyard & Intermediate Maintenance Facility
NWCF	Navy Working Capital Fund
PACFLT	Pacific Fleet
PHNSY	Pearl Harbor Naval Shipyard



United States General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-280524

September 10, 1999

The Honorable James M. Inhofe
Chairman, Subcommittee on Readiness
and Management Support
Committee on Armed Services
United States Senate

Dear Mr. Chairman:

In recent years, the Navy has implemented many changes aimed at making its fleet support activities more efficient and effective. An underlying assumption was that consolidating similar activities within a region could eliminate the inefficiencies and redundancies. In 1998, as part of this effort, the Navy implemented a pilot project consolidating the management, operations, and funding of the Pearl Harbor Naval Shipyard and the Naval Intermediate Maintenance Facility in Hawaii. The Navy expects that the pilot project, commonly called the Pearl Harbor Pilot, will serve as a model for other potential consolidations by confirming that integrating shipyard and intermediate activities can result in greater efficiency and lower overall unit costs.

As you requested, we examined the Navy's progress in implementing this pilot project. This report discusses (1) the preliminary results of the Pearl Harbor Pilot on improving performance of maintenance activities, (2) the usefulness of the pilot as a model for future consolidations, and (3) issues related to financial and organizational structures for such consolidations. Our scope and methodology are described in appendix I.

Results in Brief

Although the Pearl Harbor Pilot is not complete, preliminary results have been mixed, showing either improvements, no improvements, or insufficient data to determine results. Where data are available, overall indications are that the pilot has the potential to improve maintenance activities in Hawaii. While the Navy's pilot test plan calls for evaluating performance using nine metrics, data has been gathered for only five to compare performance under the consolidated operation with performance under the preconsolidation organizations. Preliminary results for two metrics indicate improvements that meet or exceed the Navy's expectations, and two others indicate improvements that fall slightly short

of the Navy's expectations, while one metric indicates no improvement. Other positive results include increasing workforce flexibility by integrating nearly 4,000 workers from two work centers into a single workforce. Consequently, the number of workers assigned daily to the excess labor shop has dropped from about 200 to below 10. Furthermore, the Navy has reduced the maintenance infrastructure by 11 buildings (114,131 square feet) and plans to eliminate another 6 buildings (24,907 square feet). At the same time, other anticipated efficiencies have yet to be realized. For example, not all the industrial plant equipment has been consolidated and the projected number of overhead workers has not been moved to direct maintenance positions to improve productivity.

The Pearl Harbor Pilot is likely to serve only as a general model for future consolidation efforts because of unique aspects of ship maintenance activities in Hawaii, such as the close proximity of facilities and the large portion of fleet-funded work than in other locations. Likewise, because of this uniqueness, the pilot provides only a general indication that future consolidations elsewhere will result in similar efficiencies. Nevertheless, it does provide general information on such issues as combining workforces from separate activities and consolidating equipment and facilities.

The Pearl Harbor Pilot has sharpened the debate over the most appropriate financial and organizational structures for such consolidated activities. Conflicting views continue to exist within the Departments of Defense and the Navy over whether these consolidated activities should operate under direct appropriations, the Navy Working Capital Fund, or a combination of the two financial structures, particularly in terms of maintaining visibility over total operational costs. Similarly, little progress has been made toward resolving the departments' differences over the most appropriate organizational structure to manage these types of activities.

This report recommends that the Navy take steps to address unresolved issues related to financial and organizational structures as it proceeds with similar consolidations.

Background

In March 1994, the Chief of Naval Operations (CNO) announced a Regional Maintenance Program to streamline the Navy ship repair and maintenance processes, reduce infrastructure and costs, and maximize outputs. The program consisted of three phases: (1) optimizing intermediate-level maintenance through consolidation of intermediate activities, (2) integrating intermediate and depot activities with management by the

fleet commanders, and (3) conducting fleet maintenance using a single process. The first phase, optimizing intermediate-level maintenance by minimizing redundant intermediate ship maintenance capacity and capability, is nearing completion. To ensure the validity of the second phase of the program and to provide a model for other potential consolidations, the Navy implemented the Pearl Harbor Pilot in 1998. Its completion date has not been established. The third phase, performing a single maintenance process by using common business and production processes, is under way and scheduled to be completed in fiscal year 2001.

The Pearl Harbor Pilot

Prior to the consolidation, the Navy recognized that organizational and funding structures inhibited the ability of the Pearl Harbor Naval Shipyard (PHNSY) and Naval Intermediate Maintenance Facility (NIMF) to readily share workloads and resources. The shipyard was managed by the Naval Sea Systems Command (NAVSEA) and funded through the Navy Working Capital Fund (NWCF),¹ while the intermediate maintenance facility was managed by the Pacific Fleet (PACFLT) and financed through direct appropriations.² During the pilot, PACFLT assumed ownership and overall management and financial responsibility for the consolidated activity, while NAVSEA continued to be the technical and operating authority. The Navy named the combined activity the Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility (NSY & IMF). To achieve a fully integrated organization, the Navy decided the Pearl Harbor Pilot should use a single financial structure and selected direct appropriations rather than the working capital fund as the funding approach. This latter decision was based on several factors, but Navy officials believed that direct appropriations were better suited to achieve the pilot goals and matched the financial structure of the largest shipyard customer—PACFLT.

¹ Under the working capital fund arrangement, activities such as a shipyard sell goods and services to customers based on predetermined rates designed to recoup the full cost of goods and services, including any military personnel costs. Customers pay for the goods and services with their operation and maintenance funds. The fund's accounting practices and related requirements for disclosure of information are intended to help managers and workers focus on production costs and performance. However, the Department of Defense (DOD) has long-standing problems in accumulating and reporting the full costs associated with its working capital fund operations.

² Direct appropriations are sometimes referred to as mission funding by DOD and Navy officials. They are funds appropriated directly by the Congress that authorize agencies to incur obligations for designated purposes. An agency may not spend more than the amount appropriated.

Furthermore, in recent years there has been increasing Navy dissatisfaction with the costs associated with the working capital fund. Given the nature of the fund and its emphasis on fully recovering costs of the services provided, the perception sometimes exists that the fund included fees and charges that inflated ship maintenance costs compared to mission funding, which does not reflect the full cost of operations. In accordance with one of the basic tenets of a working capital fund, the costs associated with ship maintenance are more visible when financed using this mechanism. While the level of resources required to carry out ship maintenance activities is likely to be similar regardless of whether financed using mission funding or through a working capital fund, under the working capital fund the customer is more likely to be directly responsible for a larger portion of those costs. Use of a working capital fund better enables DOD components to fully account for their share of the program costs. In commenting on a draft of this report, the Navy said that it chose the Shipyard Management Information System as the cost accounting system for the Pearl Harbor Pilot. According to the Navy, this system (which is used by other naval shipyards under the NWCF) provides the pilot the same degree of cost visibility as a working capital fund activity.

Full accounting for the costs of federal programs is required by federal accounting standards. Specifically, Statement of Federal Financial Accounting Standards No. 4 requires federal agencies to accumulate the full cost of outputs through appropriate costing methodologies or cost finding techniques (the full cost of an output is the sum of (1) the cost of resources consumed that directly or indirectly contributes to the output and (2) the cost of identifiable supporting services provided by other entities).

**After Expressing Concerns,
Department of Defense
Officials Approved the Test
Plan in September 1998**

In 1998, as Navy officials were formulating plans for the Pearl Harbor Pilot, DOD officials expressed concern that the Navy's test plan and baseline data would not adequately measure the pilot's impact on productivity and performance. Consequently, the Navy revised the test plan and tried to minimize the data limitations in the baseline. Ultimately, as shown in table 1, the Navy selected nine test metrics to evaluate the pilot's effectiveness.

Table 1: The Navy's Nine Test Metrics for Evaluating the Pearl Harbor Pilot's Effectiveness

Metric
1. Total cost of a production shop, direct labor hour of work delivered to the customer (indicator of the pilot's efficiency in terms of the cost per direct maintenance hour)
2. Total labor hours expended to deliver a production shop, direct labor hour to the customer (indicator of the pilot's productivity in terms of personnel utilization)
3. Total Current Ship Maintenance Program work items completed (indicator of the pilot's productivity in terms of the number of work items completed)
4. Total Current Ship Maintenance Program work items in the backlog (indicator of the material conditions of PACFLT ships in terms of work items not yet completed)
5. Schedule adherence of CNO maintenance projects (indicator of customer satisfaction in terms of completing projects on schedule)
6. Rework index for CNO maintenance projects (indicator of the pilot's quality of work in terms of hours required to correct work deficiencies)
7. Activity work schedule integrity index (indicator of customer satisfaction in terms of completing projects on schedule)
8. Casualty reports caused by activity work (indicator of the pilot's quality of work in terms of casualty reports—ship reports indicating equipment failure)
9. Earned value (indicator of the pilot's productivity in terms of hours to complete similar work items)

Source: The Pearl Harbor Pilot Test Plan, as amended, Department of the Navy (June 30, 1998).

In June 1998, the DOD Inspector General had recommended the Navy delay the pilot and restart the data collection process, applying the same data collection methodologies and controls for the baseline that would be used to collect data during the pilot period. According to DOD Comptroller and Inspector General officials, the most severe of the metrics' limitations affected the baseline costs for the first two test metrics shown in table 1. For example, military personnel costs were not traditionally collected by intermediate maintenance facilities because these facilities were largely funded out of operation and maintenance appropriations while military personnel costs were already paid for separately out of military personnel appropriations. Consequently, military personnel costs were also accounted for separately. In addition, some labor hours appeared to be inaccurate. One DOD contractor reported the NIMF database contained zero labor hours for approximately 6 percent of the maintenance tasks completed by the facility. Further, some Navy officials expressed concern that some recorded labor hours appeared to reflect the expected work standards and not actual production hours.

In response to the DOD Inspector General recommendation, Navy officials said the pilot was too far along in the integration process in June 1998 to reestablish separate maintenance activities without incurring significant cost and operational turmoil. The expected cost and turmoil of such a reversal, according to these officials, would outweigh any potential benefit obtained from developing a better baseline. Consequently, the Navy revised the test plan to minimize the data limitations. For example, as CNO and NAVSEA officials requested, the Naval Audit Service (NAS) agreed to validate the baseline and pilot results for six of the nine test metrics.³ In several instances, baseline data were routinely collected by preconsolidation activities, and they are available to provide a basis for comparison with postconsolidation performance data. In addition, as requested by CNO and NAVSEA officials, the NAS developed a methodology to estimate baseline values for the first two metrics. The methodology is based on the Navy's personnel wages and standards, as well as, on the best available data from the former NIME. Although the resulting baseline estimates for the two metrics may not be exact, Navy officials believe they are comparable to historical trends for intermediate maintenance facilities and, consequently, provide a reasonable baseline on which to indicate the pilot's impact on productivity and performance. On September 14, 1998, the Principal Deputy Under Secretary of Defense (Comptroller) approved the Navy's test plan. Appendix II provides more detail concerning the evolution of the test plan and the nine metrics.

Congressional Requirements for the Pearl Harbor Pilot

The Conference Report for the DOD Appropriations Act for Fiscal Year 1998⁴ recognized that the Navy planned to initiate a pilot to study whether combining fleet intermediate maintenance facilities with Navy shipyards might yield economies of scale and allow maintenance managers to better balance workloads. The conferees concluded that it would take at least 2 years before the Navy could determine whether this new arrangement was effective and should be made permanent or expanded to other locations. Further, the report directed the Navy not to expand the pilot until 6 months after it reported to the Committees on Appropriations on its findings, and that such report be made on or after April 1, 1999. The conferees also directed the Navy not to make any permanent changes to

³ Previously, the NAS had agreed to collect and validate the baseline and pilot results for the first two test metrics.

⁴ House Report 105-265, September 23, 1997.

the workforce in terms of total number of employees or any other permanent changes until the pilot had been completed and evaluated by the Congress. Currently, the Navy plans to issue an interim report on the pilot shortly after October 1999.

While the Pilot Has Potential to Improve Maintenance Activities, Preliminary Data Show Mixed Results

Preliminary results of the Pearl Harbor Pilot have been mixed, showing either improvements, no improvements, or insufficient data to determine results. For most of the measures where data are available, indications are that the pilot has the potential to improve maintenance activities in Hawaii. While the test plan calls for using nine metrics, the data has been gathered for only five of them. For these five metrics, preliminary results for two metrics indicate improvements that meet or exceed the Navy's expectations; two others indicate improvements that fall slightly short of the Navy's expectations; and one metric indicates no improvement. Other positive results include the fact that the Navy has integrated the workforces from two work centers into a common pool, increased management flexibility in assigning workers to maintenance projects based on evolving priorities, and reduced the maintenance infrastructure at Pearl Harbor. At the same time, other planned efficiencies are yet to be realized. For example, the pilot has not resulted in the number of overhead workers projected to move to direct maintenance positions or in the consolidation of all industrial plant equipment.⁵ According to Navy officials, these actions would have increased the number of people working directly on maintenance projects and the utilization of existing plant equipment.

The Pilot Has the Potential to Improve Maintenance Activities in Hawaii

The nine metrics chosen for the Pearl Harbor Pilot Test Plan represent a variety of issues and performance indicators. Although data available for some of the metrics are limited, it is sufficient to provide a general, if imprecise, indication of the pilot's impact on productivity and performance. In this case, as indicated in table 2, while test results have not yet been fully developed, the preliminary results have been mixed, showing either improvements, no improvements, or insufficient data to determine

⁵ In general, overhead workers are those employees who are not working directly on maintenance projects and are assigned to administrative and support positions such as personnel and financial departments. Direct maintenance workers are those employees who accomplish work directly identifiable to a maintenance project such as repair, maintenance, and installation of equipment and components.

results. Where data are available, overall indications are that the pilot has the potential to improve maintenance activities in Hawaii.

Table 2: Preliminary Results, Strengths, and Weaknesses of the Pearl Harbor Pilot Test Metrics

Metric (number) and anticipated goal	Preliminary results	Strengths (S) and weaknesses (W)
Improvement indicated		
Total cost of a production shop, direct labor hour of work delivered to the customer (1) Indicator of the pilot's efficiency in terms of the cost per direct maintenance hour	Indicates improvement because preliminary data show that it has cost slightly less to deliver one direct maintenance hour in fiscal year 1998, but falls short of the Navy's expectation	Variant of a traditional indicator of shipyard efficiency (S) Shipyard baseline data are considered reliable (S) NAS developed baseline estimates and plans to validate and generate the test data (S) NAS developed baseline estimates of the NIMF military personnel costs because the facility did not maintain this type of data (W) NIMF baseline data on production hours have limitations, but are considered reliable enough by Navy officials to provide a rough, if imprecise, estimate of the baseline (W)
Total labor hours expended to deliver a production shop, direct labor hour to the customer (2) Indicator of the pilot's productivity in terms of personnel utilization	Indicates improvement because preliminary data show that it has taken fewer hours to deliver one direct maintenance hour in fiscal year 1998	Variant of a traditional indicator of shipyard productivity (S) Shipyard baseline data are considered reliable (S) NAS developed baseline estimates and plans to validate and generate the test data (S) NIMF baseline data on production hours have limitations but are considered reliable enough by Navy officials to provide a rough, if imprecise, estimate of the baseline (W)
Total Current Ship Maintenance Program work items in the backlog (4) Indicator of the material conditions of PACFLT ships in terms of work items not yet completed	Indicates improvement because preliminary data show that there are fewer backlogged work items since the consolidation, but falls short of the Navy's expectation	Traditionally considered an indicator of the material condition of ships (S) Fleet and ship commanders maintain baseline and test data, which are considered reliable (S) NAS plans to validate the baseline and test data (S) Is an indicator of the NIMF and the combined facility's productivity but not the former shipyard (W)
Schedule adherence of CNO ship maintenance projects (5) Indicator of customer satisfaction in terms of completing projects on schedule	Indicates improvement because preliminary data show that more CNO projects are being completed on time or ahead of schedule since the consolidation	Traditionally considered an indicator of the shipyard customers' satisfaction (S) NAVSEA maintains baseline and test data, which are considered reliable (S) NAS plans to validate the baseline and test data (S) Is an indicator of shipyard and the combined facility's performance but not the former NIMF (W)
No improvement indicated		
Total Current Ship Maintenance Program work items completed (3) Indicator of the pilot's productivity in terms of the number of work items completed	Indicates no improvement because preliminary data show that there are fewer work items being completed since the consolidation	Fleet and ship commanders maintain baseline and test data, which are considered reliable (S) NAS plans to validate the baseline and test data (S) Is an indicator of the NIMF and the combined facility's productivity, but not the former shipyard (W) Is affected by other factors not related to the pilot (W)

(continued)

Metric (number) and anticipated goal	Preliminary results	Strengths (S) and weaknesses (W)
Not yet determined		
Rework index for CNO maintenance projects (6) Indicator of the pilot's quality of work in terms of hours required to correct work deficiencies	Not yet determined because the Navy requires additional time to develop the test data	Traditionally considered an indicator of the shipyard quality of work (S) NAS plans to validate the baseline and test data (S) Is an indicator of shipyard and the combined facility's performance, but not the former NIMF (W)
Activity work schedule integrity index (7) Indicator of customer satisfaction in terms of completing projects on schedule	Not yet determined because the Navy does not plan to gather data needed to develop this metric unless the results of the first six metrics are inconclusive	Traditionally considered an indicator of the shipyard customers' satisfaction (S) Shipyard maintains baseline and test data, which are considered reliable (S) Is an indicator of shipyard and the combined facility's performance, but not the former NIMF (W) Is similar to the fifth metric measuring schedules adherence and, as a result, Navy officials question the usefulness of developing this metric (W)
Casualty reports caused by activity work (8) Indicator of the pilot's quality of work in terms of casualty reports	Not yet determined because the Navy does not plan to gather data needed to develop this metric unless the results of the first six metrics are inconclusive	Fleet and ship commanders maintain baseline and test data, which are considered reliable (S) Is an indicator of shipyard and the combined facility's performance, but not the former NIMF (W) Is similar to the sixth metric measuring rework and, as a result, Navy officials question the usefulness of developing this metric (W)
Earned value (9) Indicator of the pilot's productivity in terms of hours to complete similar work items	Not yet determined because the Navy does not plan to gather data needed to develop this metric unless the results of the first six metrics are inconclusive	Attempts to measure the pilot's effect on maintenance outputs (S) Should require significant resources to develop results (W) Is based on a limited universe of work items (W)

Note(s): Results as of June 22, 1999.

Appendix II provides more detail concerning the strengths and weaknesses of the nine metrics.

Source: Interviews with Navy officials and our analysis of the Pearl Harbor Pilot Test Plan dated June 30, 1998; NAS capacity evaluation reports for fiscal years 1997 and 1998; and pilot status reports.

As shown in table 2, two test metrics indicate improvements that meet or exceed the Navy's expectations and two indicate improvements that fall slightly short of the Navy's expectations; only one metric indicates no improvement. Because of the operational turbulence experienced during the consolidation, we believe that it is reasonable to expect that some productivity and performance indicators might show diminished improvement during the transition year. In addition, as indicated in the table, the Navy has not gathered performance data for the remaining four metrics. The Navy is in the process of collecting test data on the rework index for CNO maintenance projects. However, Navy officials do not plan

to gather data needed to develop the last three metrics unless the test results are inconclusive, even though the three metrics were added to the test plan at the request of the Principle Deputy Under Secretary of Defense (Comptroller).

Other Efficiencies Identified During the Planning Process Have Been Achieved

In August 1997, the Pearl Harbor Regional Maintenance Pilot Executive Steering Committee issued the Pilot Study Report for the integration of the PHNSY and NIMF.⁶ The purpose of the report was to outline the approach for this integration. Among other improvements, the report envisioned increasing productivity and cost-effectiveness by integrating the workers of former PHNSY and NIMF into a common workforce and reducing the ship maintenance infrastructure in Hawaii. As planned in the Pilot Study Report, the Navy has integrated nearly 4,000 workers from two separate work centers into a common pool, increased management flexibility in assigning workers to maintenance projects, and reduced the ship maintenance infrastructure.

Prior to the pilot, it was difficult to shift work or personnel between maintenance activities due to multiple financial structures. More specifically, the Navy stated that NWCF rules prohibited assigning workers to a job without a funding document, which made it difficult to shift work between maintenance activities. Accordingly, when administrative and financial requirements restricted the movement of workers, shipyard production personnel not working on a specific maintenance project were sent to the excess labor shop to wait assignment. During this time, they performed indirect work such as facility maintenance or grounds-keeping.⁷ Before the pilot, the number of workers assigned daily to this shop ranged between 100 to 200. By integrating the workforce under a single financial and command structure, production shops now have more flexibility in assigning excess workers to other projects, including projects historically completed by the former intermediate maintenance facility. Consequently, the number of workers assigned daily to the excess labor shop has dropped to below 10.

⁶ *Pilot Study Report for an Integration of Pearl Harbor Naval Shipyard and Naval Intermediate Maintenance Facility, Pearl Harbor*, Pearl Harbor Pilot Executive Steering Committee (Aug. 26, 1997).

⁷ Limited-duty personnel with medical injuries or health problems and personnel whose security clearance levels were under review were also assigned to the excess labor shop.

In addition, as a result of the consolidation, the Navy has reduced the maintenance infrastructure at Pearl Harbor. For example, 11 (114,131 square feet) of the 27 buildings previously used by the former intermediate maintenance facility were vacated and turned over to Pearl Harbor Naval Station.⁸ While the consolidated facility will retain 7 of the remaining 16 NIMF buildings, it plans to vacate another 6 (24,907 square feet) and is reviewing the disposition of 3 buildings.⁹ As of June 1999, the Pearl Harbor Naval Station demolished or plans to demolish eight former NIMF buildings and was able to demolish two of its buildings after tenants moved into vacated NIMF buildings. The demolition costs for all 10 buildings is estimated at \$1.9 million with a projected annual cost avoidance of \$307,000 or a payback period of a little over 6 years.

Some Efficiencies Have Yet to Be Fully Achieved

The Pilot Study Report envisioned increasing productivity and cost-effectiveness by moving overhead workers to direct maintenance positions and consolidating industrial plant equipment. However, these efficiencies have not yet been fully achieved.

For example, the consolidation did not result in the projected number of overhead workers moving to direct maintenance work—an important element in increasing the combined facility's productivity. To increase productivity, one of the stated goals of the pilot was to increase the number of direct production workers relative to the number of supervisors and overhead personnel without increasing costs. Logically, increasing the number of production workers should result in increased production. To accomplish this goal, the Pilot Study Report proposed that 95 civilian overhead workers be moved to positions in direct maintenance work. However, only four workers moved. According to Pearl Harbor NSY & IMF officials, while they have tried, it has been impracticable for them to move civilians to such positions because of (1) the time required for overhead workers to become skilled, usually several years; (2) regulations restricting the process for downgrades; and (3) potentially negative action by workers

⁸ In general, the Pearl Harbor Naval Station has ownership and is responsible for the management and maintenance of Navy buildings in Hawaii.

⁹ According to Navy officials, no former shipyard buildings will be vacated as a result of the Pearl Harbor Pilot.

and employee representatives.¹⁰ In addition, several department directors and overhead supervisors said they were unwilling to release any personnel because of the increased workload due to changes in administrative and financial systems since the consolidation. Furthermore, other Navy officials said that efforts to move supervisors to direct production resulted in too few supervisors, which led to problems in planning and coordinating work on maintenance projects. According to CNO and NAVSEA officials, more overhead workers will be moved to direct maintenance positions as the pilot progresses.

In addition, industrial plant equipment has not been completely consolidated at integrated production shops. The Pilot Study Report suggested the in-shop industrial equipment be efficiently consolidated and redistributed to improve maintenance operations. Of the 271 items of industrial equipment at the former intermediate maintenance facility, 114 items were relocated, 132 items were mothballed, and 25 items were kept operational at their original location. According to officials formerly associated with the Pearl Harbor NSY & IMF, the 114 related items were equipment that required little or no removal and installation costs. Although many of the 132 mothballed items are in better condition and newer than the same type of equipment located currently in the consolidated shops, the funding required to relocate the NIMF equipment has not been available. Most mothballed items are semipermanently attached heavy equipment that requires funding to remove, transport, and install elsewhere. According to Pearl Harbor officials, congressional guidance directing the Navy not to make any permanent changes until after the pilot period has to a lesser degree influenced the decision not to relocate the mothballed items. They plan to request funding to move equipment after the pilot period is completed.

The Pearl Harbor Pilot Will Serve Only as a General Model for Similar Consolidations

The Pearl Harbor Pilot is likely to serve only as a general model for future consolidation efforts because of the unique aspects of ship maintenance activities in Hawaii, such as the close proximity of facilities and the significant portion of fleet-funded work. Likewise, because of this

¹⁰ Our prior work examining DOD reform initiatives has noted the importance of top management commitment and sustained support for reform initiatives, as well as overcoming culture barriers and resistance to change. See *Defense Reform Initiatives: Organization, Status, and Challenges* (GAO/NSIAD-99-87, Apr. 21, 1999).

uniqueness, the pilot provides only a general indication that future consolidations will result in similar efficiencies.

While there can be clear benefits to regionalization, available statistical data suggest conditions may have been more favorable to such efforts in Pearl Harbor than may exist at other Navy locations. For example, during fiscal years 1996 through 1998, the Navy reportedly replaced 698 military personnel at the former NIMF with 504 experienced civilian workers, mostly from the shipyard. Although civilian workers were periodically transferred between intermediate facilities and shipyards at other locations, Pearl Harbor is the only location where a significant number of workers has recently been transferred. Consequently, according to Navy officials, this large cadre of civilian workers with recent shipyard experience should have expedited the integration of the workforce by requiring less training and fewer trade skill certifications. This condition does not exist to such a large extent at other potential consolidation locations, except at the Puget Sound area. Table 3 compares some additional differences between Pearl Harbor and other Navy locations.

Table 3: Comparison of Ship Maintenance Activities in the Pearl Harbor, Puget Sound, Portsmouth, and Norfolk Areas

Dollars in millions				
Category	Pearl Harbor	Puget Sound	Portsmouth	Norfolk
Time required to travel between the intermediate maintenance facilities and the shipyards	• 5 to 10 minutes	• 20 to 30 minutes to the Trident Refit Facility • 2 to 4 hours to Everett, Washington, maintenance facility	• 2 to 3 hours to Groton, Connecticut, maintenance facility	• 30 to 45 minutes to the Shore Intermediate Maintenance Activity
Reported shipyard revenues	\$379.4	\$1,041.8	\$394.1	\$822.1
Number of military personnel				
• Shipyard	43	47	53	64
• Intermediate maintenance facility or activity	641	1,105	1,134	2,516
Number of civilian personnel				
• Shipyard	2,742	8,823	3,286	7,127
• Intermediate maintenance facility or activity	554	967	149	23

Note: Fiscal year 1998.

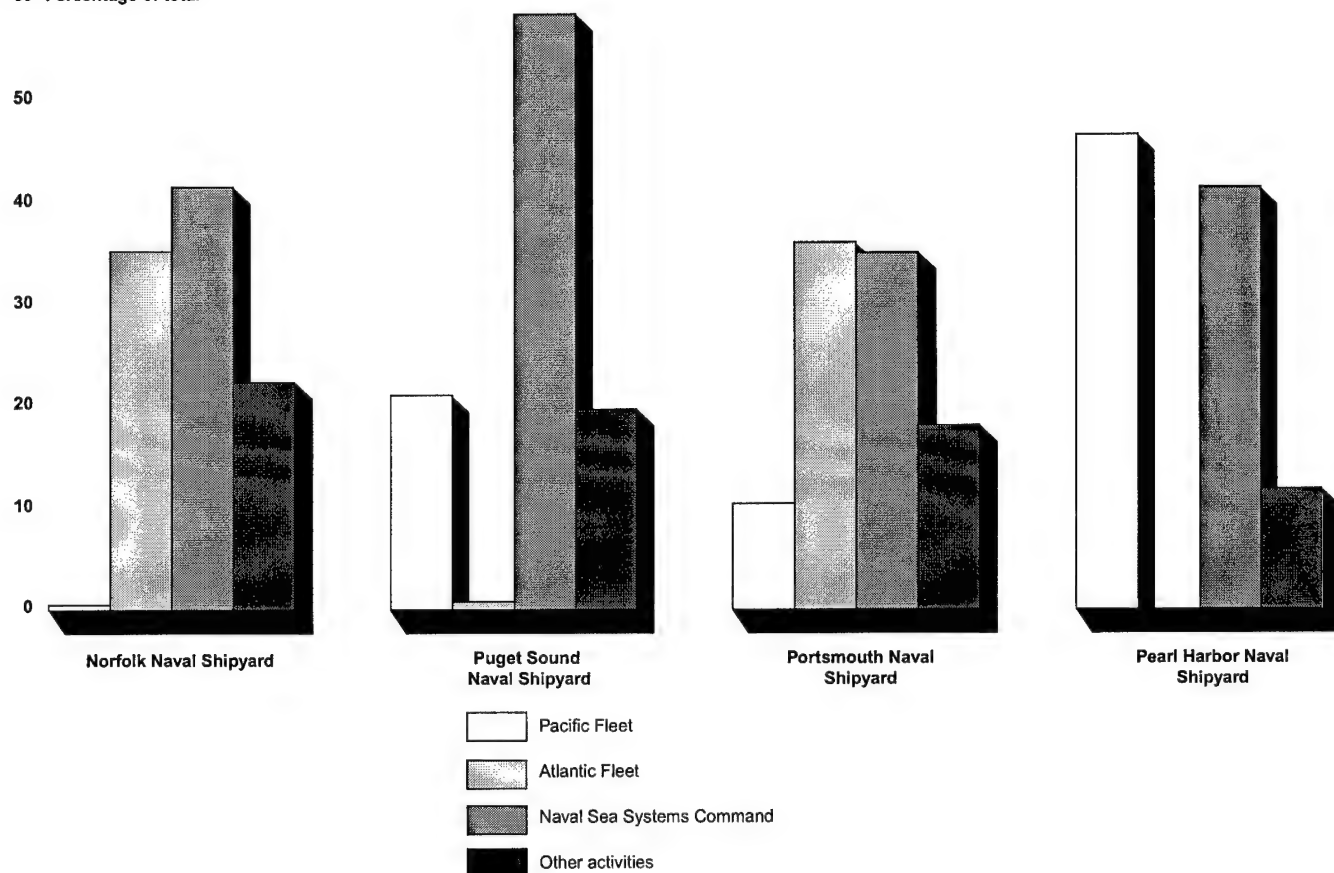
Source: Our analysis of interviews and documents obtained from Navy officials.

As indicated in table 3, Pearl Harbor facilities are located closer to each other than in other Navy locations. Consequently, consolidation of activities separated by greater distances at other Navy locations could be more difficult to manage and, after the consolidation is completed, could possibly reduce the combined facility's flexibility in the management of the workforce and workload. For example, given the close proximity of facilities in Hawaii, workers with multiple and specialized skills from both the former PHNSY and NIMF can move between ship maintenance projects and emergent work in a few minutes compared to other Navy locations where transportation time could range up to 4 hours. In addition, the consolidated production shops in Hawaii are able within a few minutes to pick up and deliver replacement parts for maintenance projects compared to other locations, where delivery time could range up to 4 hours once the shops are consolidated. Consequently, the longer transportation time between facilities at other Navy locations could extend the time frames for maintenance projects compared to projects completed in Hawaii. Further, as indicated in table 3, Pearl Harbor facilities differ in terms of revenues and staffing than in some of the other areas. For example, except for the Portsmouth Naval Shipyard, reported revenues and staffing for the other two shipyards were more than double the amount of the PHNSY. The smaller mission at Pearl Harbor should have made the consolidation easier.

In addition during fiscal year 1997, as indicated in figure 1, more of the PHNSY workload was for the fleet compared with the other three naval shipyards that completed more work for non-fleet activities. According to Navy officials, a single major customer should simplify the integration and management of ship maintenance activities. They indicated that it is much easier to schedule and budget for maintenance projects on behalf of one primary and a few secondary customers compared to meeting the varying requirements of several different customers with equal workloads.

Figure 1: Breakdown of the Naval Shipyards' Fiscal Year 1997 Workloads by Major Customer

60 Percentage of total



Source: Our analysis of NAVSEA data.

In the future, Navy officials estimated that nearly 90 percent of the Pearl Harbor NSY & IMF workload would be for PACFLT. The remaining 10 percent will be completed under a reimbursable basis for other activities. According to Navy officials, the large share of PACFLT workload in Hawaii should reduce the need for the combined maintenance activity to broker large workloads between different Navy activities. At the same time, having one common financial system should eliminate the need for potentially unwieldy financial processes and procedures to manage and budget for different work and funding sources. In other locations, NAVSEA and the

respective fleet are estimated to share the ship maintenance workload on a more equitable basis.

Issues Related to Financial and Organizational Structures Need to Be Resolved

The Pearl Harbor Pilot has sharpened the debate over the most appropriate financial and organizational structures for such consolidated activities. Conflicting views continue to exist within the Departments of Defense and the Navy over whether these consolidated activities should operate under direct appropriations, the NWCF, or a combination of the two financial structures, particularly in terms of maintaining visibility over total operational costs. Similarly, little progress has been made toward resolving the departments' differences over the most appropriate organizational structure to manage these types of activities. Consequently, we believe these issues need to be resolved to facilitate effective and efficient consolidations.

Issues Remain Unresolved Regarding Financial Structure

The Navy's proposal recommending direct appropriations for the Pearl Harbor Pilot stated that the pilot provided an actual demonstration of using direct appropriations for a "major maintenance activity," which would help to determine the ultimate financial structure for the Navy's regionalization actions. The proposal further stated that a common financial structure needed to be tested by means of the pilot. However, the Navy's test plan does not attempt to measure the impact of using a single financial structure or the benefit of using direct appropriations instead of the working capital fund. At the same time, DOD and Navy officials continue to have different views on the potential impact of using direct appropriations for the pilot on the productivity and performance of the Pearl Harbor Pilot and future regionalization actions. The same is true about the command structure to be used for such consolidated operations. Consequently, we believe these issues need to be resolved to facilitate effective and efficient consolidations.

Navy Selected Direct Appropriations

Prior to the consolidation, the Navy recognized that the differences between activity management and financial structure inhibited the PHNSY's and NIMF's ability to readily share workloads and resources. According to Navy officials, the multi-financial and command structures required them to use cumbersome, workaround procedures to share workloads and workers between the former PHNSY and NIMF. Therefore, the shipyard and intermediate maintenance facility did not readily share workloads and resources because of the time and cost required to carry-out

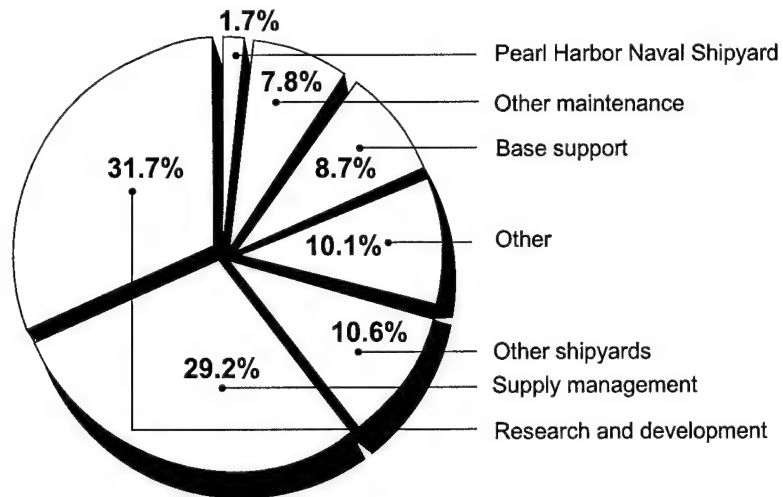
the process. To achieve a fully integrated organization, the Navy decided the Pearl Harbor Pilot should use a single financial structure and selected direct appropriations instead of the NWCF. This decision was based on several factors, but primarily because PACFLT was the larger customer of the two organizations and direct appropriations matched the fleet's financial structure. Consequently, Navy officials expected fewer financial issues under direct appropriations than NWCF because PACFLT could integrate the pilot into its existing financial structure without establishing another system.

Views on the Financial Structure Differ

DOD and Navy officials have different views regarding the financial impact of removing the PHNSY from the NWCF. There are several centrally managed functions in support of all shipyards for which the costs are recovered in the shipyard labor rates under the working capital fund structure, which are not normally captured under direct appropriations. According to DOD officials, these functions include NAVSEA personnel directly supporting shipyards, the Navy's Crane Center that manages all crane procurements and repair projects, centralized automated information systems, programming support, and other centrally managed items. In effect, removing the PHNSY from the fund without addressing the contribution (approximately 14 percent) it made to cover centrally funded costs for naval shipyards would increase their rates. However, CNO and NAVSEA officials believe the PHNSY's share of the overhead cost was not large enough to have a significant effect on the other shipyards' rates.

As shown in figure 2, the former PHNSY generated 1.7 percent of the fund's \$21.9 billion in total revenues during fiscal year 1998 and the other shipyards contributed another 10.6 percent, or \$2.3 billion.

Figure 2: Comparison of Reported NWCF Revenues by Activity Group for Fiscal Year 1998



Note: The "other maintenance" category includes aviation and U.S. Marine Corps depot maintenance activities and "other" includes ordnance, information services, and transportation activities.

Percentages do not add to 100 percent due to rounding.

Source: Our analysis of the DOD Inspector General report entitled *Inspector General, DOD, Oversight of the Naval Audit Service Audit of the Navy Working Capital Fund Financial Statements for FY 1998* (99-099, Mar. 1, 1999).

DOD officials are concerned that the Navy has not adequately addressed a potentially more significant issue regarding the impact of removing all naval shipyards from the NWCF. They believe the Navy decision to remove the shipyards from the fund would cause other Navy activities remaining in the fund to absorb a larger share of overhead costs. However, CNO and NAVSEA officials believe that the shipyards' share is not large enough to have a significant effect on the activities remaining in the fund.

Further, DOD and Navy officials have different views on other financial issues:

- Working capital funds are not directly subject to the annual appropriation cycle and can continue operations without interruption between fiscal years. Consequently, the NWCF provided former shipyard operators with significant financial flexibility because they were freed from reprogramming limitations and restrictions applicable

to regular appropriations and allowed to incur costs without waiting for enactment of an appropriation. Because this financial flexibility is considered critical to shipyard operations, DOD officials are concerned that the Navy has not addressed the impact of eliminating this flexibility on the pilot operations or future consolidations.

- The Congress established working capital funds, among other purposes, to provide a more flexible funding mechanism that would allow DOD industrial, commercial, and service activities to operate on the same basis as the private sector, including the use of standard cost accounting practices and widely-accepted management techniques. According to DOD officials, applying these practices and techniques to naval shipyards has provided cost visibility and improved the efficiency of operations. Although we found that the Navy has retained the cost visibility of the former shipyard under the pilot, the cost information is not routinely reported to the major commands as it was for the NWCF. Further, the visibility is maintained by continuing to operate the former shipyard accounting and management system, which could be eliminated after the pilot is completed. For example, DOD officials are concerned that the visibility will not be maintained after the pilot period is completed. Navy officials said they plan to maintain cost visibility of the maintenance operations in Hawaii even after the pilot period because the visibility is useful in the management of those operations. Whichever financing method is adopted after the completion of the pilot, the Statement of Federal Financial Accounting Standards No. 4 requires DOD and the Navy to continue to measure and report the full cost of such ship maintenance operations by responsibility segment.
- The buyer/seller relationship is a fundamental aspect of working capital funds. According to DOD officials, this relationship established dynamic interplay between the buyer and the provider that encouraged cost control and responsiveness to customer requirements. In addition, it provided the opportunity for shipyard customers to focus their attention on accomplishing their respective missions and shipyard operators to be accountable and responsive to customers' needs. Absent reimbursements for most maintenance transactions at Pearl Harbor under direct appropriations, CNO and NAVSEA officials said that a buyer/seller relationship has largely been eliminated. They estimated that only 10 percent of the combined facility's future workload, such as ship alterations and inactivations, will continue to be on a reimbursable basis after the pilot period.
- According to DOD officials, another important aspect of working capital funds is their capital investment program. In the case of the NWCF, the former shipyard depreciated its capital assets and collected this

expense from customers through its rates. Therefore, the fund had a ready reserve to finance capital investments for the shipyard. According to CNO and NAVSEA officials, NAVSEA will budget for future capital improvements for the Pearl Harbor NSY & IMF. However, DOD officials are concerned that future funding levels may be insufficient because of uncertainties in the DOD budgeting and appropriation process.

Discussions of Other Financial Structures Continue

Although other similar regionalization efforts are likely, according to Navy officials, they may not look like the Pearl Harbor Pilot with direct appropriations as the single financial structure. For example, Navy officials are currently discussing using either direct appropriations or the working capital fund to finance the combined activity of future consolidations, or a combination of the two financial structures.¹¹ One combination being discussed involves using direct appropriations to finance the overhead and military personnel of the combined facility while using the NWCF to finance direct maintenance work and materials. Because they believe that the working capital fund is more costly and less flexible than direct appropriations, several Navy officials are reluctant to use the fund to finance the cost of intermediate maintenance activities, which are currently financed with direct appropriations.

Differing Views Remain Regarding Organizational Structure

The Navy has made little progress toward resolving questions over the appropriate organizational structure for such consolidations. While the proposal recommending the pilot's financial structure stated that common ownership was believed to be beneficial to the Navy's regional maintenance initiative, it needed to be tested by the pilot. However, the Pearl Harbor Pilot Test Plan does not attempt to measure the impact of providing PACFLT ownership and management responsibilities for the pilot and Navy officials are uncertain which command structure should be used for similar consolidations at other locations.

Although the pilot was expected to streamline the maintenance process and eliminate stovepipe organizations, DOD and Navy officials do not know the extent to which the pilot's current structure is meeting these objectives or how they might have been met under other command structures. Prior to the pilot, the NIMF operated as a PACFLT activity while the former shipyard operated as a NAVSEA activity. Under the pilot,

¹¹ In its comments on a draft of this report, the Navy said that NAVSEA and the Fleet Commanders had agreed now to operate future consolidations under direct appropriations.

PACFLT assumed ownership and overall management and financial responsibility for the consolidated activity while NAVSEA continued to be the technical and operating authority. Although CNO and NAVSEA officials viewed the duality of fleet ownership and NAVSEA operation as not adding another management layer, according to several DOD and other Navy officials, this appeared to add a level of responsibility and oversight in lieu of streamlining the former maintenance structure and eliminating organizations. For example, several Pearl Harbor NSY & IMF officials said that the current ownership and command structure has resulted in the practice of reporting and coordinating simultaneously with both commands. In addition, there has been some confusion on which command was ultimately responsible for collecting test data and analyzing the results of the pilot. Navy officials are still undecided about the appropriate organizational structure for these types of activities and are considering different structures for other regionalization efforts.

Conclusions

Although the Pearl Harbor Pilot is not complete, preliminary results have been mixed, showing either performance improvements, no improvements, or insufficient data to determine results. For most of the measures where data are available, indications are that the pilot has the potential to improve maintenance activities in Hawaii. However, because of unique aspects of ship maintenance activities in Hawaii, the pilot is likely to serve only as a general model for future consolidation efforts and provides only a general indication that future consolidations will result in similar efficiencies. At the same time, DOD and Navy officials continue to have different views on the potential impact of using direct appropriations to finance the pilot on (1) the Navy shipyards and activities remaining in the working capital fund, (2) ship maintenance activities during periods without appropriations, (3) cost visibility of ship maintenance activities, (4) incentives inherent under NWCF's buyer/seller relationship for improving productivity and performance, and (5) the capital investment program for ship maintenance activities. Other issues that are still unresolved include determining whether the pilot's organization structure under PACFLT ownership has helped streamline the ship maintenance process and improve operations in Hawaii.

Recommendations

As the Navy proceeds with other similar consolidations, we recommend that the Secretary of Defense require the Secretary of the Navy to resolve issues related to the appropriate mechanism to finance and manage these

types of activities. Specific financial questions that need to be resolved include the impact of using the direct appropriations to finance the pilot and other potential regionalization actions with regard to (1) the Navy shipyards and activities remaining in the working capital fund, (2) ship maintenance activities during periods without appropriations, (3) cost visibility of ship maintenance activities, (4) incentives inherent under NWCF's buyer/seller relationship for improving productivity and performance, and (5) the capital investment program for ship maintenance activities. In addition, other questions that need to be resolved include determining whether the pilot's command structure under the Fleet's ownership has helped streamline the ship maintenance process and improve operations in Hawaii.

Agency Comments and Our Evaluation

On August 5, 1999, we requested comments on a draft of this report from the Secretary of Defense. On August 31, 1999, officials of the Office of the Assistant Deputy Under Secretary of Defense for Maintenance Policy, Programs, and Resources said that they concurred with the intent of our recommendations. However, DOD Comptroller officials expressed concern that the draft of this report did not adequately address the Navy's underlying assertions and assumptions for the pilot or whether the stated objectives of the pilot were met. By recommending that the Navy take steps to address unresolved issues related to financial and organizational structures as it proceeds with similar consolidations, we believe our report addresses the most significant issues for such consolidations. Because the pilot is not yet complete, we did not attempt to determine whether the stated objectives were fully met but, instead, reported the preliminary results of the pilot on improving performance and maintenance activities in Hawaii. We believe that it could take several years for the full effects of the pilot to develop and, as requested, we are reporting the preliminary results.

In addition, Navy officials said that they generally concurred with the draft of this report except for our use of fiscal year 1998 data to indicate the preliminary results of the Pearl Harbor Pilot, and they advised that fiscal year 1999 data would provide the most valid assessment of the pilot. They considered fiscal year 1998 as a transition year when the maintenance activities, financial systems, and workforce were not fully integrated and, consequently, did not indicate the pilot's full performance. As discussed in this report, we also considered fiscal year 1998 as a transition year for the pilot and reported that the pilot was unlikely to result in significant improvements during the transition year because of the operational turbulence experienced during the consolidation. However, we used

available data from both the transition year and fiscal year 1999 to provide the preliminary results of the pilot. We continue to believe that, in either year, overall indications are that the pilot has the potential to improve maintenance activities in Hawaii.

DOD and the Navy also provided technical corrections and clarifications and, where appropriate, we incorporated them in the report.

We are sending copies of this report to Senator Pete V. Domenici, Senator Daniel K. Inouye, Senator Frank R. Lautenberg, Senator Carl Levin, Senator Joseph I. Lieberman, Senator Fred Thompson, Senator Ted Stevens, Senator Charles S. Robb, and Senator John W. Warner, and to Representative John R. Kasich, Representative Jerry Lewis, Representative John P. Murtha, Representative Ike Skelton, Representative Floyd Spence, and Representative John M. Spratt, Jr., in their capacities as Chair or Ranking Minority Member of cognizant Senate and House Committees and Subcommittees. We are also sending copies of this report to the Honorable William S. Cohen, Secretary of Defense; the Honorable William J. Lynn, Under Secretary of Defense (Comptroller); the Honorable Richard Danzig, Secretary of the Navy; and the Honorable Jacob Lew, Director, Office of Management and Budget. Copies will also be made available to others upon request.

GAO contacts and key contributors to this report are listed in appendix III.

Sincerely yours,

A handwritten signature in black ink, reading "David R. Warren". The signature is fluid and cursive, with a long horizontal stroke at the end.

David R. Warren, Director
Defense Management Issues

Scope and Methodology

During our review, we obtained data and interviewed Departments of Defense (DOD) and Navy officials, including those from the offices of the Under Secretary of Defense (Comptroller), Deputy Under Secretary of Defense for Logistics, DOD Inspector General, Assistant Secretary of the Navy for Financial Management and Comptroller, Chief of Naval Operations (CNO), Naval Sea Systems Command (NAVSEA), the Pacific Fleet (PACFLT), Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility (NSY & IMF), San Diego Supervisor of Ship Building Conversion and Repair Pearl Harbor Detachment, and the Naval Audit Service (NAS). In addition, we interviewed officials of the Hawaii Federal Employees Metal Trades Council, the Ship Repair Association of Hawaii, and contractors involved in the management and assessment of the Pearl Harbor Pilot.

To identify the preliminary results of the Pearl Harbor Pilot, we obtained and reviewed status reports and briefings, financial and human resources documents, infrastructure data, budget documents, NAS capacity evaluation reports and documents, the Pearl Harbor Pilot Test Plan and related guidance, and PACFLT regional maintenance and business plans. In addition, we interviewed DOD and Navy officials to discuss the preliminary results of the pilot and challenges that must be resolved to obtain the full benefits of the consolidation. We observed the operations of the Pearl Harbor NSY & IMF and interviewed superintendents, first-line supervisors, and workers to identify operational conditions and determine the pilot's impacts on their maintenance shops and activities. We reviewed the Pearl Harbor Pilot Study Report and other planning documents to identify maintenance procedures and processes expected to improve under the pilot and compared these expectations with actual operational results for fiscal year 1998 and the beginning of fiscal year 1999. When these results did not meet expectations, we discussed the differences with Navy officials to determine the causes and identify expectations for future operations. In addition, we interviewed officials of various PACFLT commands (customers of the Pearl Harbor NSY & IMF) to determine whether the combined facility's maintenance activities and services were comparable to those provided prior to the consolidation. Additionally, we interviewed Navy officials and collected data on the apprentice program, safety and quality assurance programs, and issues related to the morale of Pearl Harbor NSY & IMF.

To assess the adequacy of the Pearl Harbor Pilot Test Plan, we reviewed the DOD Inspector General's preliminary assessment of the test plan and baseline data. We also interviewed DOD, Navy, and contractor officials

about the methodology for the test plan, reliability of the data, and strengths and weaknesses of each test metric. To obtain an understanding of the methodology and data reliability, we reviewed the process and data used to develop the fiscal year 1997 baseline, the fiscal year 1998 transition results, and the fiscal year 1999 preliminary results and, on a selected basis, we traced the data to their original source documents. To identify potential areas for improving the test plan, we discussed the strengths and weaknesses of the test plan with DOD, Navy, and contractor officials. We also discussed several key elements of the pilot that were omitted from the test plan, including the reasons for omission or the potential need for inclusion.

To identify issues that remain for future consolidations at other Navy locations, we obtained and reviewed status reports and briefings, financial and human resources documents, the Pearl Harbor Pilot Test Plan and related guidance, and PACFLT regional maintenance and business plans. In addition, we interviewed DOD and Navy officials to discuss issues that must be resolved to obtain the full benefits of the Pearl Harbor consolidation and other similar consolidations at other Navy locations. In addition, during meetings with DOD and Navy officials, we discussed the advantages and disadvantages of whether future consolidations should use direct appropriations, the Naval Working Capital Fund (NWCF), or a combination of the two financial systems. To help assess the potential impact of removing the former Pearl Harbor Naval Shipyard (PHNSY) and other naval shipyards from the NWCF, we identified and analyzed the percentage of revenues the former PHNSY and the other shipyards contributed to the fund during fiscal years 1997 and 1998. We also discussed the potential impact of their removal from the fund with DOD and Navy officials. Additionally, during meetings with DOD and Navy officials, we discussed the advantages and disadvantages of whether NAVSEA or the fleets should be responsible for the ownership and management of future consolidations. To determine whether the pilot could serve as a model for similar consolidations at other locations, we identified and analyzed reasons why the Navy selected Pearl Harbor maintenance activities for the pilot. We compared these conditions with those found at the Puget Sound, Portsmouth, and Norfolk areas and discussed the potential impact of these differences on other consolidations with DOD and Navy officials.

Furthermore, we documented the reasons the Navy selected direct appropriations, and the pilot's experience of operating under direct appropriations. We also interviewed DOD and Navy officials to discuss the

actual level of cost visibility retained under the pilot and the various levels considered adequate for ship maintenance activities. In addition, we determined the level of cost visibility retained for four ongoing maintenance projects for the U.S.S. *Charlotte*, U.S.S. *Russell*, U.S.S. *Tucson*, and U.S.S. *Crommelin*. Specifically, we reviewed the start date, estimated date of completion, estimated cost, direct labor hours of military and civilian personnel, overtime hours, material and supply cost, and contract services for the projects. In addition, to determine whether the same level of detail was being maintained by the Pearl Harbor NSY & IMF under direct appropriations, we reviewed material expenditures and labor-hours for military and civilian personnel by job order number for the projects.

In performing this review, we used the same budget and accounting systems, reports, and statistics DOD and the Navy use to manage and monitor their ship maintenance program. We did not independently determine the reliability of the reported financial information. However, our recent audit of the federal government's financial statements, including DOD's and the Navy's statements, questioned the reliability of reported financial information because not all obligations and expenditures are recorded to specific budgetary accounts.

We conducted our review from May 1998 to July 1999 in accordance with generally accepted government auditing standards.

Description of the Pearl Harbor Pilot Test Plan and Its Strengths and Weaknesses

The Navy's test plan for assessing the effectiveness of the Pearl Harbor Pilot evolved between December 1997, when the Deputy Secretary of Defense first required a test plan, and September 1998, when the last three test metrics were added to the plan. During this evolution, DOD, Navy, and audit agency officials expressed various concerns with the scope and validity of the test plan. Ultimately, the Navy selected nine test metrics to evaluate the productivity and performance of the pilot.

Metrics to Be Used to Evaluate the Pilot

After several revisions and additions, the current test plan contains nine metrics that capture unit cost per output, production efficiency, material readiness of ships home ported at Pearl Harbor, and customer satisfaction. During the initial planning period in late 1997, Navy officials discussed several metrics to measure the impact of the pilot and initially agreed upon the two shown in table 4.

Table 4: Navy's Initial Two Metrics to Test Whether the Consolidated Pearl Harbor NSY & IMF Increased Manpower Utilization and Lowered Unit Cost of Production

Metric	Data elements	Calculation
1. Total cost of a production shop, direct labor hour of work delivered to the customer	<ul style="list-style-type: none">• Total costs of the ship maintenance activity• Total production shop, direct labor hours delivered	<ul style="list-style-type: none">• Total costs of the ship maintenance activity or activities divided by the total production shop, direct labor hours delivered
2. Total available labor hours expended to deliver a production shop, direct labor hour to the customer	<ul style="list-style-type: none">• Total available labor hours, including direct and indirect hours, expended by the ship maintenance activity• Total production shop, direct labor hours delivered	<ul style="list-style-type: none">• Total available labor hours divided by the total production shop, direct labor hours delivered

Source: Interviews with Navy officials and our analysis of the Pearl Harbor Pilot Test Plan dated June 30, 1998.

In December 1997, recognizing that the Navy had not developed a plan or established a baseline for measuring success or failure for the pilot, the Deputy Secretary of Defense required the Navy to develop a test plan to measure the benefits of the pilot.¹ In addition, the Deputy Secretary of Defense suggested that “productive man-days delivered per dollar outlay” and “number of civilian end strengths and military on-board it took to

¹ Program Budget Decision Number 404, Deputy Secretary of Defense (Dec. 11, 1997).

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produce the productive man-days" should be used as key assessment metrics. Subsequently, the Chief of Naval Operations (CNO) and the Naval Sea Systems Command (NAVSEA) requested the Naval Audit Service (NAS) determine the combined cost of operations for the former Pearl Harbor Naval Shipyard (PHNSY) and the Naval Intermediate Maintenance Facility (NIMF) for fiscal year 1997.² In an April 1998 report, the NAS provided a basis to compare the cost effectiveness of combining the two maintenance activities and metric calculations for the two assessment metrics defined at that time, which are the first two metrics of the current test plan.³ In the report, the NAS recognized that the consolidation was an evolving process and revisions to its report may be necessary to reflect changes in consolidation decisions. In May 1999, after making changes to the baseline data and fine-tuning its methodology, the NAS revised its baseline cost and productivity estimates.⁴ The revised estimates did not change significantly from the initial estimates.

In April 1998, the Navy issued a draft of the Pearl Harbor Pilot Test Plan that included five metrics to capture cost per unit output, production efficiency and resource utilization, material readiness of PACFLT ships, customer satisfaction, and quality. However, in June 1998, the DOD Assistant Inspector General for Auditing stated that the draft test plan would not provide sufficient or supportable data to draw conclusions about the effectiveness of consolidating the operations of the former shipyard and intermediate maintenance facility. Consequently in June 1998, a joint DOD and Navy team issued a revised Pearl Harbor Pilot Test Plan that changed the basis for the quality metric from formal customer surveys to an analysis of rework items and added a metric measuring the number of

² The Navy selected fiscal year 1997 as the baseline year because this was the last full year the former PHNSY and NIMF operated as independent activities. Fiscal year 1998 was eliminated because of the operational turbulence expected by the consolidation of activities during the year. Fiscal year 1996 was eliminated because there were separate surface ship and submarine intermediate maintenance facilities operating during the fiscal year.

³ *Capacity Evaluation Report: Baseline Costs of Operating Naval Intermediate Maintenance Facility, Pearl Harbor and Pearl Harbor Naval Shipyard*, Auditor General of the Navy (98-0400, Apr. 1998).

⁴ *Capacity Evaluation Report: Revised Baseline Costs of Operations and Metrics for Naval Intermediate Maintenance Facility, Pearl Harbor and Pearl Harbor Naval Shipyard Consolidation*, Auditor General of the Navy (99-0408, May 1999).

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work-items completed.⁵ Consequently, the Navy included four metrics in addition to those two metrics listed in the previous table to its final test plan. (See table 5.)

Table 5: Metrics Three Through Six to Test Whether the Consolidated Pearl Harbor NSY & IMF Increased Manpower Utilization and Lowered Unit Cost of Production

Metric	Data elements	Calculation
3. Total Current Ship Maintenance Program (CSMP) work items completed	<ul style="list-style-type: none"> Total number of CSMP work items completed on ships home ported at Pearl Harbor during the fiscal year 	<ul style="list-style-type: none"> None required, absolute number of completed CSMP work items used
4. Total Current Ship Maintenance Program work items in the backlog	<ul style="list-style-type: none"> Total number of CSMP work items in the backlog for ships home ported at Pearl Harbor 	<ul style="list-style-type: none"> None required, absolute number of CSMP work items in the backlog used
5. Schedule adherence of CNO maintenance projects	<ul style="list-style-type: none"> Sum of the differences in the actual and scheduled completion dates for each CNO ship maintenance project completed during the fiscal year Sum of the scheduled duration (number of days) for each CNO maintenance project completed during the fiscal year 	<ul style="list-style-type: none"> Sum of the differences in the actual and scheduled completion dates divided by the total scheduled duration (number of days) for each CNO scheduled ship maintenance project completed during the fiscal year
6. Rework index for CNO maintenance projects	<ul style="list-style-type: none"> Sum of the labor hours expended to correct work deficiencies for each CNO scheduled ship maintenance project completed during the fiscal year Total production shop, direct labor hours delivered for each CNO scheduled ship maintenance project completed during the fiscal year 	<ul style="list-style-type: none"> Sum of the labor hours expended to correct work deficiencies divided by the total number of direct labor hours delivered for each CNO scheduled ship maintenance project completed during the fiscal year

Source: Interviews with Navy officials and our analysis of the Pearl Harbor Pilot Test Plan dated June 30, 1998.

In September 1998, the Principal Deputy Under Secretary of Defense (Comptroller) suggested the Navy incorporate three additional test metrics developed under contract by the Anteon Corporation into the revised June 1998 test plan.⁶ (See table 6.) In response, the Acting Deputy Chief of Naval

⁵ The Pearl Harbor NSY & IMF has developed three additional internal metrics: production-shop hours versus total available hours, direct production worker versus non-production worker, and civilian labor cost per labor hour. While they are not formally part of the test plan, Pearl Harbor NSY & IMF officials believe the metrics will assist them in assessing the effectiveness of the pilot.

⁶ *The Pearl Harbor Pilot Study*, Anteon Corporation (Sept. 10, 1998).

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Operations (Logistics) attached them in an appendix E to the plan. At this time, Principal Deputy Under Secretary of Defense approved the test plan.

Table 6: Metrics Seven Through Nine to Test Whether the Consolidated Pearl Harbor NSY & IMF Increased Manpower Utilization and Lowered Unit Cost of Production

Metric	Data elements	Calculation
7. Activity work schedule integrity index	<ul style="list-style-type: none"> Budgeted quantity of work scheduled (labor days) Actual quantity of work performed (labor days) 	Budgeted allowance of work scheduled (labor days) divided by the actual amount of work performed (labor days)
8. Casualty reports ^a caused by activity work	<ul style="list-style-type: none"> Casualty reports 	Analysis of reports occurring within 6 months following the completion of maintenance
9. Earned value	<ul style="list-style-type: none"> Actual quantity of work performed (labor days) for selected Ship Work Line Item Numbers for the fiscal year 	Statistical analysis of actual quantity of work performed (labor days) for selected Ship Work Line Item Numbers for fiscal years 1997 and 1999

^aReports filed by the ship of equipment failures that may indicate faulty work performed during more recent maintenance projects.

Source: Interviews with Navy and Anteon Corporation officials and our analysis of the Pearl Harbor Pilot Test Plan dated June 30, 1998.

In November 1998, the Director, Industrial Capability, Maintenance Policy and Acquisition Logistics Division, CNO, requested the NAS to assume the overall lead and control in the test plan assessment process. The Director requested that NAS involvement be expanded to include data collection for all of the test plan metrics, metric calculation and assessment, and pilot metric assessment reporting. In response, the auditors agreed to continue to develop and report data for the first two metrics in the test plan and verify the data for metrics number 3 through 6. Additionally, NAS considered the responsibility for data collection and reporting the results of the pilot to be a management function. It did not assume responsibility for collecting and validating the data for the contractor-generated metrics.

Baseline, Performance Expectations, and Preliminary Values for the Pearl Harbor Pilot

Given the time and data constraints in developing the Pearl Harbor Pilot Test Plan, the test plan and assessment metrics provide the Navy a mechanism for evaluating the pilot's productivity and performance. As shown in table 7, the Navy has developed the values for the fiscal year 1997 baseline and performance expectations for six of the nine metrics and

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preliminary values for five metrics. However, the details for collecting and analyzing the contractor-generated metrics have not yet been determined.

Table 7: Baseline, Performance Expectations, and Preliminary Results of the Test Plan

Metric	Fiscal year 1997 baseline	Expectation	Preliminary result
1. Total cost of a production shop, direct labor hour of work delivered to the customer ^a	• \$135.36 in current year dollars • \$138.13 in adjusted dollars ^b	• 3-5 percent reduction	• \$135.59 per hour in fiscal year 1998
2. Total available labor hours expended to deliver a production shop, direct labor hour to the customer ^a	• 3.15 hours	• 3-5 percent reduction	• 3.04 hours in fiscal year 1998
3. Total Current Ship Maintenance Program work items completed ^c	• 19,777	• Maintain at least the same completion rate	• 14,568 items in fiscal year 1998 • 7,786 items as of May 1999
4. Total Current Ship Maintenance Program work items in the backlog ^c	• 17,733	• 10 percent reduction	• 16,462 items as of September 30, 1998 • 16,538 items as of May 1999
5. Schedule adherence of CNO maintenance projectsc	• 11.4 percent late	• To improve	• 18.6 percent late in fiscal year 1998 • 3.7 percent early in fiscal year 1999 through May 1999
6. Rework index for CNO maintenance projectsc	• 0.086	• No degradation of the index	• Not yet determined
7. Activity work schedule integrity index	• Not yet determined	• Unclear	• Not yet determined
8. Casualty reports caused by activity work	• Not yet determined	• Unclear	• Not yet determined
9. Earned value	• Varies by work item	• Unclear	• Not yet determined

^aReported by the NAS.

^bAdjusted for increases in military and civilian pay rates due to inflation.

^cReported by the Pearl Harbor NSY & IMF, but not yet verified by the NAS.

Source: Interviews with Navy and Anteon Corporation officials and our analysis of the Pearl Harbor Pilot Test Plan dated June 30, 1998; NAS capacity evaluation reports for fiscal years 1997 and 1998; and pilot status reports.

Although the Navy has established nine metrics that provide indicators of productivity and performance, the metrics have data limitations and weaknesses that preclude their use for precise measurements. Nevertheless, they provide a basis for an order of magnitude comparison. A discussion of the nine metrics follows.

Cost of a Production Shop,
Direct Labor Hour of Work
Delivered

Measuring the pilot's efficiency in terms of the cost per direct maintenance hour, the Navy's first metric is determined by dividing the total activity cost by the number of production shop, direct labor hours delivered to the customer.⁷ The NAS estimated that it cost \$135.36 to deliver one production shop, direct labor hour in fiscal year 1997—the baseline year for measuring the pilot's success. For the pilot to show improvement, this index should decrease, indicating that since the consolidation, it cost less to deliver a direct maintenance hour. The NAS estimated that the index was \$135.59 during the fiscal year 1998 transition, indicating some improvement when compared with the adjusted baseline of \$138.13, but falling short of Navy's performance expectation of 3- to 5-percent reduction in the index.⁸ The NAS adjusted the baseline to account for differences in military and civilian wages and inflation between fiscal years 1997 and 1998. Because of the operational turbulence experienced during the consolidation, we believe this indicator was unlikely to show a significant improvement during the transition year.

Strengths and Weaknesses

In analyzing this metric, we noted strengths and weaknesses. The strengths of this metric are that the baseline is partly based on shipyard data, which are considered reliable, and the NAS developed the baseline estimates and plans to validate and generate the test data. However, DOD and Navy officials have expressed concern with the accuracy of the intermediate maintenance data collected during the baseline year, which is considered a weakness. For example, military personnel costs were not collected because intermediate maintenance facilities traditionally did not collect these costs. In addition, some production hours appeared to be inaccurate. For example, a DOD contractor reported the former NIMF database contained zero labor hours for approximately 6 percent of the maintenance tasks completed by the facility. Consequently, to strengthen the metric, the NAS developed a methodology that used Navy personnel wages and standards and the best available NIMF data to estimate a baseline for this metric. Although the NIMF baseline data on military personnel costs and

⁷ The production shops consist of the crane, ship fitter, sheet metal, welding, inside machine, outside machine, boilermaker, electrical, pipe fitter, wood/fabric, cryptographic shore electronics, electronics, shipwright/rigging, and temporary services shops and the Navy calibration and nuclear regional maintenance departments.

⁸ *Fiscal Year 1998 Interim Costs for the Consolidated Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, Pearl Harbor*, Auditor General of the Navy (99-0400, June 1, 1999).

Appendix II
Description of the Pearl Harbor Pilot Test
Plan and Its Strengths and Weaknesses

production hours have limitations, they are considered reliable enough by Navy officials to provide a rough, if imprecise, estimate of the baseline.

Labor Hours Expended to
Deliver a Production Shop,
Direct Labor Hour

Measuring the pilot's productivity in terms of personnel utilization, the second metric is determined by dividing the total number of available labor hours by the number of production shop, direct labor hours delivered to the customers. The NAS estimated that it took 3.15 activity labor hours (overhead and direct maintenance hours) to deliver one production shop, direct labor hour in fiscal year 1997. For the pilot to show improvement, this index should decrease indicating that it has taken fewer overhead hours to generate 1 direct maintenance hour since the consolidation. The NAS reported that the index decreased to 3.04 hours in fiscal year 1998, indicating a 3.5-percent improvement during the transition year. This met the low end of the Navy's performance expectation of 3- to 5-percent reduction in value.

Strengths and Weaknesses

In our analysis, we noted the strengths and weaknesses of this metric. The strengths of this metric are that the baseline is partly based on shipyard data, which are considered reliable, and the NAS developed the baseline estimates and plans to validate and generate the test data. However, as discussed previously, DOD and Navy officials have expressed concern with the intermediate maintenance data collected during the baseline year. Consequently, to strengthen the metric, the NAS developed a methodology that used best available NIMF data to estimate a baseline for this metric. Although the NIMF baseline data on production hours have weaknesses, they are considered reliable enough by Navy officials to provide a rough, if imprecise, estimate of the baseline.

Current Ship Maintenance
Program Work Items
Completed

Measuring the pilot's productivity in terms of output, the third metric is the number of Current Ship Maintenance Program (CSMP) work items completed by the Pearl Harbor NSY & IMF. Although this metric is not an indicator of the former shipyard's productivity, Navy officials have considered the number of CSMP work items completed by their intermediate maintenance facilities as a measurement of their productivity.⁹ The CSMP is the central database for the maintenance history of each ship and contains corrective, preventative, and alteration

⁹ Traditionally, naval shipyards completed a minimal number of CSMP items.

maintenance items requiring work. The Pearl Harbor NSY & IMF estimated that the former intermediate maintenance facility completed 19,777 CSMP work items in fiscal year 1997. However, it further estimated that the consolidated activity completed 14,568 CSMP work items during the fiscal year 1998 transition and 7,786 work items as of May in fiscal year 1999, indicating no improvement in performance since the consolidation. Although the combined facility was expected to maintain the same completion rate as the former NIMF, several Navy officials believe that this expectation was unreasonable because the number of military enlisted personnel decreased from 1,275 in October 1996 to 616 in April 1999. Traditionally, enlisted personnel completed the majority of CSMP work items. Consequently, Navy officials have discussed lowering the performance expectation for this metric.

Strengths and Weaknesses

During our analysis, we found that this metric had both strengths and weaknesses. The strengths of this metric are that the fleet and ship commanders maintain the baseline and test data, which are considered reliable, and the NAS plans to validate the baseline and pilot results. However, other factors not related to the pilot affect the metric that weaken its usefulness. For example, Navy officials have expressed concern with using CSMP work items to measure the benefits of the Pearl Harbor Pilot because one work item does not equal another item in terms of the labor hours, work skills, time frame, and material cost required. CSMP items range from replacing a light bulb in a control panel, which may take a worker less than an hour to replace, to overhauling a pump, which may take several workers days to complete. In addition, the requirements needed to overhaul one pump differ from other overhauls depending on the problem and the type of pump. Although this metric has weaknesses that preclude its use for precise measurements, Navy officials believe that it provides a basis for an order-of-magnitude comparison.

Current Ship Maintenance Program Work Items in the Backlog

Historically, Navy officials have measured the material condition of their ships based on the number of backlogged CSMP items. Fewer backlogged items imply that the ships are in better condition. The Navy's performance expectation for the combined facility was to reduce the estimated 17,733-baseline backlog by 10 percent to 15,960 work items. Recently, the Pearl Harbor NSY & IMF estimated that the backlog decreased to 16,538 items as of May 1999. Although this decrease indicates improvement, it falls short of the Navy's expectation for the pilot. However, it was unlikely that the CSMP backlog would decrease significantly during this period because

of the reduction in the number of military enlisted personnel since October 1996.

Strengths and Weaknesses

As discussed previously, using CSMPs as a test metric had both strengths and weaknesses. The strengths of this metric are that it traditionally has been considered an indicator of the material condition of fleet ships and that the fleet and ship commanders maintain the baseline and test data, which are considered reliable. In addition, the NAS plans to validate the baseline and pilot results. For many of the same reasons that CSMP work items are not a precise measurement of output, the backlog is not a precise measurement of the ship's material condition, which makes the backlog a weakness in regard to measurement. For example, one work item related to the safety of a nuclear submarine could potentially restrict the submarine operations, while a similar item on a surface ship could have little or no effect on its operations. Additionally, other factors affecting the backlog include non-pilot related items such as

- decommissions of PACFLT ships homeported at Pearl Harbor, which decrease the backlog by the number of CSMP items recorded for the decommissioned ship;
- visits by the U.S.S. *McKee* (a maintenance tender), which decrease the backlog by the number of CSMP items completed by the tender;
- maintenance inspections, which increase the backlog by the number of unrecorded CSMP items identified by the inspection team; and
- procedural changes in identifying and recording CSMP items, which may increase or decrease the backlog depending on whether the changes weaken or strengthen the process.

Although this metric has weaknesses that preclude its use for precise measurements, Navy officials believe that it provides a basis for an order-of-magnitude comparison.

Schedule Adherence of CNO Maintenance Projects

According to Navy officials, adherence to completing CNO maintenance projects on schedule should provide an indication of customer satisfaction because, from the fleet and ship commanders' perspective, these maintenance projects should be completed on schedule.¹⁰ The performance

¹⁰ CNO maintenance projects include depot-level maintenance that require skills or facilities beyond those of the ship and intermediate maintenance activities and are completed by public and private shipyards.

expectation during the pilot test was to reduce the 11.4 percent schedule adherence index achieved during fiscal year 1997, since a lower percentile would indicate that projects were being completed closer to their scheduled completion dates.¹¹ According to the Pearl Harbor NSY & IMF, the schedule adherence index increased to 18.6 percent during fiscal year 1998—indicating a worsening performance during the transition year. However, Pearl Harbor NSY & IMF data showed that the schedule adherence index for the CNO maintenance projects completed in fiscal year 1999 has exceeded the Navy's performance expectations for the pilot. For example, although the first CNO project completed in fiscal year 1999 was 20 percent late, the four subsequent CNO projects have been either on time or early, decreasing the cumulative index to 3.7 percent early.

Strengths and Weaknesses

The strengths of this metric are that it traditionally has been considered an indicator of the shipyard customers' satisfaction and that NAVSEA maintains the baseline and test data, which are considered reliable. In addition, the NAS plans to validate the baseline and pilot results. The weaknesses include that the metric is based solely on the former shipyard's performance in meeting the completion dates for CNO maintenance projects and, consequently, does not include all types of maintenance projects. Pearl Harbor NSY & IMF officials believe this metric should include fleet maintenance projects because there are more fleet maintenance projects than CNO projects, thus affecting more ship commanders. However, according to CNO and NAVSEA officials, they included only CNO projects for this metric because the schedule adherence data for fleet maintenance projects were considered of minimal value. For example, the former intermediate maintenance process was to defer work rather than to extend the duration of fleet maintenance projects and, consequently, these projects were generally completed on time. Because the pilot has not changed this process for fleet maintenance projects, CNO and NAVSEA officials believe an analysis of schedule adherence data for these projects would be of minimal value in assessing the pilot's effectiveness.

¹¹ The schedule adherence index is the sum of the differences in the actual and scheduled completion dates divided by the total scheduled duration (number of days) for each CNO ship maintenance project completed during the fiscal year.

Rework Index for CNO
Maintenance Projects

In analyzing this metric, we found strengths and weaknesses. Measuring the quality of work completed by the Pearl Harbor NSY & IMF, the sixth metric is determined by dividing the total number of direct rework hours required to correct work deficiencies by the number of direct labor hours delivered for CNO maintenance projects completed during the fiscal year. Rework hours are the hours spent to correct work deficiencies after the maintenance project is completed.

Strengths and Weaknesses

The strengths of the metric are that it traditionally has been considered an indicator of the shipyard quality of work and the NAS plans to validate the baseline and test data. However, its weaknesses include that the baseline for this metric is limited to the shipyard's CNO projects because the former intermediate maintenance facility did not collect rework data for its projects. In addition, the metric has not been computed for fiscal years 1998 or 1999 because no one has assumed responsibility for tracking this information since the inception of the pilot.

Activity Work Schedule
Integrity Index

Measuring the pilot's degree of schedule integrity, the seventh metric is calculated by dividing the budget quantity of work (direct labor hours) scheduled by the actual amount of work (direct labor hours) delivered to complete the maintenance project. According to the test plan, actual work exceeding budgeted work indicates inefficiencies in the facility's planning or production processes. A metric value of more than one indicates the maintenance project was completed within budget.

Strengths and Weaknesses

The strengths of this metric are that it traditionally has been considered an indicator of the shipyard customers' satisfaction and the shipyard maintains the baseline and test data, which are considered reliable. However, one weakness of metric is that it does not include data from the former intermediate maintenance facility. In addition, Navy officials believe this metric is similar to the fifth metric measuring schedule adherence and, therefore, is not significantly useful in determining the benefits of the pilot. Consequently, they have not expended resources to compute the metric value for the baseline year or established performance expectations for this metric. Furthermore, the details of collecting and analyzing the data have not yet been determined. According to CNO and NAVSEA officials, the Navy does not plan to gather the data needed to develop and analyze this metric unless the results of the first six metrics are inconclusive. For example, if the pilot results for those six metrics are mixed, then it may be necessary to measure other pilot results, such as this metric.

Casualty Reports Caused by
Activity Work

Measuring the quality of work completed by the Pearl Harbor NSY & IMF, the eighth metric is based on analysis of casualty reports. These reports are filed by the ship after any equipment failure and may help identify work improperly performed by the Pearl Harbor NSY & IMF. Those reports indicating improperly performed work may offer insight to potential corrective actions to the facility's methods and procedures.

Strengths and Weaknesses

We noted strengths and weaknesses in our analysis of this metric. The primary strength of the metric is that the fleet and ship commanders maintain the baseline and test data, which are considered reliable. However, considered a weakness, the metric does not include data from the former intermediate maintenance facility. In addition, Navy officials believe this metric is similar to the sixth metric measuring rework items and, therefore, is not significantly useful in identifying the benefits of the pilot. Consequently, they have not expended resources to determine the details of collecting and analyzing the data for this metric. Similar to the previous metric, the Navy does not plan to gather the data needed to develop and analyze this metric unless the results of the first six metrics are inconclusive.

Earned Value

For the earned value metric, the process determines the value of a completed task by comparing actual labor hours it took to complete a unit of ship maintenance work in fiscal year 1997 with actual labor hours it took to complete the same unit of work in fiscal year 1999 and subsequent test years. This metric attempts to measure the pilot's effect on maintenance outputs. Based on an analysis of the former shipyard and NIMF production and labor data for fiscal year 1997, the Anteon Corporation identified 14 surface ship and submarine systems that were considered cost drivers, consuming the most labor hours during the fiscal year.¹² On the basis of the distribution of labor hours for each of these cost drivers, the Anteon Corporation determined that, while the distributions are nearly identical in form, they were not distributed normally at the 99.9 percent confidence level. The most common statistics used to describe data normally distributed are the mean and standard deviation. In this case, however, the mean and standard deviations do not adequately represent the data distribution. Consequently, non-parametric statistics—which are generally

¹² The Anteon Corporation defined a cost driver as a quantity of ship maintenance work that represented a major or controlling portion of work on a particular ship maintenance project.

based on the median (as opposed to the mean)—and percentile ranges (as opposed to the standard deviation) of the distribution of labor hours will be used to describe the labor hour distribution for each of the cost drivers.

If the distribution of labor hours for the 14 cost drivers in fiscal year 1999 is less than the fiscal year 1997 baseline, the earned value metric indicates that the productivity of the work performed at the combined facility has improved compared to when the facilities operated separately. Conversely, if distribution of labor hours in fiscal year 1999 is greater than the fiscal year 1997 baseline, the productivity of the combined facility has decreased compared to when the facilities operated separately. Although it is expected that the cost drivers from fiscal year 1997 will be similar to those in fiscal year 1999, a statistical method will be used to verify that the data for the different fiscal years are similar. If the data are not statistically similar, additional analysis of data will be conducted to develop the earned value metric.

Strengths and Weaknesses

A strength of this metric is that it attempts to measure the pilot's effect on maintenance outputs. However, the primary weakness of the metric, according to Navy officials, is that it affects such a small population that the metric is not significantly useful in measuring the efficiency of the pilot. Another stated weakness is that the metric requires significant resources to develop the results. Consequently, Navy officials have not expended resources to determine the details of collecting and analyzing the data for the metric. Similar to the previous two metrics, the Navy does not plan to gather the data needed to develop and analyze this metric unless the results of the first six metrics are inconclusive.

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